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Gary S Williams  
Pennie & Edmonds L L P  
3300 Hillview Avenue  
Palo Alto, CA 94304

EXAMINER

ROMANO, JOHN J

ART UNIT

PAPER NUMBER

2122

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/005,923	<b>Applicant(s)</b> FLANAGAN ET AL.	
	<b>Examiner</b> John J Romano	<b>Art Unit</b> 2122	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 04 December 2001, 13 March 2002.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-51 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-51 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 December 2001 is/are: a) ☒ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>13 March 2003</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

Claims 1-51 are pending in this action.

### ***Information Disclosure Statement***

1. The Information Disclosure Statement filed on December 11th, 2001 has been considered.

### ***Drawings***

2. The drawings are objected to because the specification refers to "intermediate modified computer program 124", however 124 is an "Annotation Inference System".

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the

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applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims **1-8, 14-28, 32-42 and 46-51** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson, US 5,423,027 (hereinafter **Jackson**) in view of Saxe et al., US 6343,376 (hereinafter **Saxe '376**).

5. In regard to claim **1**, **Jackson** discloses:

- *"A method of annotating a computer program ..."* (E.g., see Figure 6 & Column 5, lines 62-67), wherein annotation is disclosed.
- *"...a) applying a program checking tool to the computer program to produce one or more warnings..."* (E.g., see Figure 1 & Column 4, lines 53-56), wherein the checker program tool is applied to the code and produces an approximate specification or a warning.
- *"...b) mapping at least one of said warnings into at least one annotation modification..."* (E.g., see Figure 6 & Column 5, lines 62-

67), wherein the checker program adds lines of aspect specifications or annotations to the code where relevant (mapping) as shown in figure 6.

- "...c) *modifying the computer program in accordance with said at least one annotation modification so that the number of annotations in the computer program changes, thereby producing a modified computer program...*" (E.g., see Figure 6 & Column 5, lines 62-67), wherein the code is modified with an annotation, thereby increasing the number of annotations in the program.

But **Jackson** does not expressly disclose "repeating each of steps a, b and c until no warnings produced... are suitable for mapping into an annotation modification" or "providing a user with the modified computer program in which is found at least one annotation". However, **Saxe '376** discloses:

- "...d) *repeating ...*" (E.g., see Figure 2 & Column 7, lines 19-26), wherein edited code may be fed back to a condition generator causing the process to repeat from the beginning.
- "...e) *providing a user with the modified computer program in which is found at least one annotation.*" (E.g., see Figure 2 & Column 7, lines 16-18), wherein the display manager provides the user the modified computer program in which is found at least one annotation.

**Jackson** and **Saxe '376** are analogous art because they are both concerned with the same field of endeavor, namely, a condition or specification or warning

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automatically generated and tested for analyzing computer software. Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxe's** teaching of repeating a process of a verification condition generated, tested and reported to a user. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27).

6. In regard to claim **2**, the rejections of base claim **1** are incorporated.

Furthermore, **Jackson** discloses:

- "...wherein at least a subset of said warnings are warnings about potential misapplications of primitive operations in the computer program." (E.g., see Figure 6 & Column 13, lines 25-29), wherein Figure 6 shows the specification to check an array's size, which if out of bounds would be a misapplication of a primitive operation such as an array access error.

7. In regard to claim **3**, the rejections of base claim **2** are incorporated.

Furthermore, **Jackson** discloses:

- "...prior to said mapping, said warnings about potential misapplications of primitive operations in the computer program are identified, and said modifying comprises inserting into the computer program at least one annotation that is produced by mapping at least one of said warnings about potential misapplications of primitive operations into an

*annotation modification.*" (E.g., see Figure 6 & Column 3, line 43-48), wherein prior to mapping to an error the annotation is mapped to the code where the location is relevant.

8. In regard to claim 4, the rejections of base claim 1 are incorporated.

Furthermore, **Jackson** discloses:

- "...prior to said applying, a candidate set of heuristically derived annotations is inserted into the computer program." (E.g., see Figure 2 & Column 4, lines 53-56), wherein the set of specifications are approximate or a candidate set.

9. In regard to claim 5, the rejections of base claim 4 are incorporated.

Furthermore, **Jackson** discloses:

- "...at least a subset of said warnings are warnings about inconsistencies between the computer program and one or more of the annotations." (E.g., see Figure 2 & Column 3, lines 1-11), wherein the dependencies or inconsistencies between the computer program and one or more of the annotations are compared.

10. In regard to claim 6, the rejections of base claim 5 are incorporated.

Furthermore, **Jackson** discloses:

- "...said modifying comprises removing from the computer program one of said heuristically derived annotations identified by said at least one annotation modification." (E.g., see Figure 2 & Column 12, line 61 – Column 13, line 2), wherein when repeating and using heuristically

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derived annotations or annotations from a previous pass the user may opt to omit or remove such modifications upon an error generation.

11. In regard to claim 7, the rejections of base claim 4 are incorporated.

Furthermore, **Saxe '376** discloses:

- "...a candidate invariant for a variable *f*." (E.g., see Figure 2 & Column 2, lines 50-55), wherein the axiom database (220) contains a candidate rule or invariant which may be applied to a variable.

Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxe's** teaching of candidate rule or invariant. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27).

12. In regard to claim 8, the rejections of base claim 5 are incorporated.

Furthermore, **Saxe '376** discloses:

- "...precondition for a procedure in said computer program." (E.g., see Figure 3 & Column 9, lines 38-45), wherein a precondition is verified before compilation of a particular segment of code.

Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxes '376** teaching of a precondition. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '76** (E.g., see Column 7, lines 19-27).



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13. In regard to claim **14**, the rejections of base claim **1** are incorporated.

Furthermore, **Jackson** discloses:

- "...at least one of said warnings includes an explanation." (E.g., see Figure 11 & Column 13, line 21-36), wherein the messages and errors are explanations.

14. In regard to claim **15**, the rejections of base claim **1** are incorporated.

Furthermore, **Jackson** discloses:

- "...at least one of said annotations in said modified computer program includes an explanation." (E.g., see Figure 11 & Column 13, lines 21-36), wherein the messages or explanations note discrepancies.

15. In regard to claim **16**, the rejections of base claim **6** are incorporated.

Furthermore, **Jackson** discloses:

- "...commenting out one of said heuristically derived annotations from the computer program." (E.g., see Figure 11 & Column 12, line 61 – Column 13, line 2), wherein an intentional omission or commenting out is performed.

16. In regard to claim **17**, the rejections of base claim **16** are incorporated.

Furthermore, **Jackson** discloses:

- "...adding an explanatory comment into one of said heuristically derived annotations from the computer program." (E.g., see Figure 11 & Column 13, lines 21-36), wherein the messages or explanations note

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discrepancies from the derived annotations, thus adding an explanatory comment into one of said heuristically derived annotations.

17. In regard to claim **18**, the rejections of base claim **3** are incorporated.

Furthermore, **Jackson** discloses:

- "...*annotation includes an explanatory comment.*" (E.g., see Figure 11 & Column 13, lines 21-36), wherein the messages or explanations note discrepancies from the derived annotations, thus adding an explanatory comment into one of said heuristically derived annotations.

18. In regard to claim **19**, the rejections of base claim **1** are incorporated.

Furthermore, **Jackson** discloses:

- "...*program checking tool is a type checker.*" (E.g., see Figure 11 & Column 1, lines 35-44), wherein type checking is disclosed and employed.

19. In regard to claim **20**, the rejections of base claim **1** are incorporated.

Furthermore, **Jackson** discloses:

- "...*program checking tool is an extended static checker.*" (E.g., see Figure 11 & Column 2, lines 28-34), wherein program checking tool is more powerful than a type checker or program checking tool is an extended static checker.

20. In regard to claim **21**, the rejections of base claim **1** are incorporated.

Furthermore, **Saxe '376** discloses:

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- "...tool comprises a verification condition generator and a theorem prover." (E.g., see Figure 2 & Column 2, lines 26-29).

Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxe's** teaching of a verification condition generator and a theorem prover. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27).

21. In regard to claim **22**, **Jackson** discloses:

- "A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising ..." (E.g., see Figure 10 & Column 3, lines 49-57).
- "... a program updater..." (E.g., see Figure 6 & Column 5, lines 62-67), wherein the code is updated with an annotation, thereby increasing the number of annotations in the program.

But **Jackson** does not expressly disclose "control instructions for repeatedly invoking the program checking tool, warning mapper and program updater..."

However, **Saxe '376** discloses:

- "...control instructions for repeatedly invoking the program checking tool, warning mapper and program updater..." (E.g., see Figure 2 &

Column 7, lines 19-26), wherein edited code may be fed back to a condition generator causing the process to repeat from the beginning and wherein control instructions allowing the annotated program to be fed back into the verification condition generator are inherent.

**Jackson** and **Saxe '376** are analogous art because they are both concerned with the same field of endeavor, namely, a condition or specification or warning automatically generated and tested for analyzing computer software. Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxe's** teaching of control instructions for repeatedly invoking the program checking tool, warning mapper and program updater. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27). Thus, it would have been obvious to implement these commonly used methods into **Jackson's** process.

See rejections of claim **1** for the remaining features of claim **22**.

22. As per claims **23-28** and **32-35**, this is a program product version of the claimed method discussed above, in claims **2-7**, **17**, **19-21** respectively, wherein all claimed limitations have also been addressed and/or cited as set forth above. For example, see **Jackson** (E.g., see Figure 10 & Column 3, lines 49-57). Additionally, all base claims are incorporated into the rejections as well.

23. In regard to claim **36**, **Jackson** discloses:

- *"A system for annotating a computer program with at least one annotation; the system comprising: at least one memory, at least one processor and at least one user interface, all of which are connected to one another by at least one bus..."* (E.g., see Figure 10 & Column 3, lines 49-57), wherein a computer system for annotating a computer program is disclosed.

See rejections of claim **1** and **22** for the remaining features of claim **36**.

24. As per claims **37-42** and **46-49**, this is a system version of the claimed program product discussed above, in claims **2-7**, **17**, **19-21**, respectively, wherein all claimed limitations have also been addressed and/or cited as set forth above. For example, see **Jackson** (E.g., see Figure 10 & Column 3, lines 49-57). Additionally, all base claims are incorporated into the rejections as well.

25. In regard to claim **50**, the rejections of claims **1** and **2** are incorporated, wherein all claimed limitations have also been addressed and/or cited as set forth above.

26. In regard to claim **51**, the rejections of claims **1 2, 4** and **6** are incorporated, wherein all claimed limitations have also been addressed and/or cited as set forth above.

27. Claim **9** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Jackson**, in view of **Saxe '376** and further in view of Saxe et al., US 6,553,3762 (hereinafter **Saxe '362**).

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28. In regard to claim **9**, the rejections of base claim **4** are incorporated.

Furthermore, **Saxe '362** discloses:

- "...*postcondition for a procedure in said computer program.*" (E.g., see Figure 5 & Column 24, lines 59-64), wherein a postcondition (504) is taught.

**Saxe '362** and the combined teaching of **Jackson** and **Saxe '376** over obviousness are analogous art because they are both concerned with the same field of endeavor, namely, a condition or specification or warning automatically generated and tested for analyzing computer software. Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Saxe's** teaching of a postcondition. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27). Additionally, **Jackson** teaches the dependence of the post-state to the pre-state (Column 13, lines 5-8). Thus, it would have been obvious at the time the invention was made to implement a post-state condition.

29. Claims **10-13**, **29-31** and **43-45** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Jackson**, in view of **Saxe '376** and further in view of Haley et al., US 6,154,876 (hereinafter **Haley**).

30. In regard to claim **10**, the rejections of base claim **7** are incorporated.

Furthermore, **Haley** discloses:

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- "...the form *fl=null*." (E.g., see Figure 5 & Column 14, lines 45-48), wherein not equal to null is taught.

**Haley** and the combined teaching of **Jackson** and **Saxe '376** over obviousness are analogous art because they are both concerned with the same field of endeavor, namely, a detection of programming errors in a computer program through analysis. Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Haley's** teaching of an invariant not being equal to null. The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27). Furthermore, **Haley** teaches that the comparison to null will determine the success of an allocation (Column 2, lines 46-47). Thus, it would have been obvious at the time the invention was made to implement a not equal to null invariant.

31. In regard to claim 11, the rejections of base claim 7 are incorporated.

Furthermore, **Haley** discloses:

- "...an expression that includes a comparison operator." (E.g., see Figure 36 & Column 52, lines 45-53), wherein the relational operator is a comparison operator.

Therefore, at the time the invention was made, it would have been obvious to a person of ordinary skill in the art to combine **Jackson's** process of mapping a warning into at least one annotation modification with **Haley's** teaching of comparison operator.

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The motivation to do so would have been to assist in elimination of the diagnosed error as suggested by **Saxe '376** (E.g., see Column 7, lines 19-27).

32. In regard to claim **12**, the rejections of base claim **11** are incorporated.

Furthermore, **Haley** discloses:

- "...*comparison operator is selected from the group consisting of: <, <=, =, !=, >= and >.*" (E.g., see Figure 36 & Column 52, lines 45-53), wherein the relational operator is a comparison operator and the <, <=, =, !=, >= and > operators specifically constitute a group.

33. In regard to claim **13**, the rejections of base claim **11** are incorporated.

Furthermore, **Haley** discloses:

- "...*wherein said expression includes an operand selected from the group consisting of: a variable declared earlier in a same class of the computer program; any one of the constants -1, 0, 1 ...*" (E.g., see Figure 30 & Column 59, lines 15-39), wherein -1 or 0 are indicated.
- "...*and a constant dimension in an array allocation expression in the computer program.*" (E.g., see Figure 8 & Column 46, lines 40-56, where a variable and constant array reference is taught.

But Haley does not expressly disclose "said expression includes an operand selected from the group consisting of: a variable declared earlier in a same class of the computer program; any one of the constants -1, 0, 1; and a constant dimension in an array allocation expression in the computer program". It would have been obvious at the time the invention was made, to one of ordinary skill in the art, to include a group



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consisting of "a variable declared earlier in a same class of the computer program; any one of the constants -1, 0, 1; and a constant dimension in an array allocation expression in the computer program" to include in the expression. It is common knowledge in software programming to include a group that pertains to the subject at hand and represent the logical choices. In order to constrain a list of choices to avoid errors by a user, a programmer will include the logical choices and present them to the user for application. Thus, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to implement the logical choices in a group to include in the expression.

34. As per claims **29-31** this is a program product version of the claimed method discussed above, in claims **11-13** respectively, wherein all claimed limitations have also been addressed and/or cited as set forth above. For example, see **Jackson** (E.g., see Figure 10 & Column 3, lines 49-57). Additionally, all base claims are incorporated into the rejections as well.

### ***Conclusion***

35. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Homeier, US005963739A
- Necula et al., US006128774A
- Saxe et al., US 20020083418A1

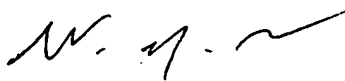
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to John J Romano whose telephone number is (571) 272-3872. The examiner can normally be reached on 8-5:30, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q Dam can be reached on (571) 272-3695. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JJR

  
WEI Y. ZHEN  
PRIMARY EXAMINER